EPIDEMIOLOGY

Estimating the population of female sex workers in two Chinese cities on the basis of the HIV/AIDS behavioural surveillance approach combined with a multiplier method

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Objective: To estimate the size of the population of female sex workers (FSWs) on the basis of the HIV/AIDS behavioural surveillance approach in two Chinese cities, using a multiplier method.

Method: Relevant questions were inserted into the questionnaires given to two behavioural surveillance groups—female attendees of sexually transmitted disease (STD) clinics and FSWs. The size of the FSW population was derived by multiplying the number of FSWs in selected STD clinics during the study period by the proportion of FSW population who reported having attended the selected STD clinics during the same period.

Results: The size of the FSW population in the urban area of Xingyi, China, was estimated to be about 2500 (95% CI 2000 to 3400). This accounted for 3.6% of the total urban adult female population. There were an estimated 17 500 FSWs in the urban area of Guiyang, China (95% CI 10 300 to 31 900) or about 3.4% of its total urban adult female population (rounded to the nearest 100).

Conclusions: The multiplier method could be a useful and cost-effective approach to estimate the FSW population, especially suitable in countries where HIV behavioural surveillance has been established in high-risk populations.

The sex trade, which was supposed to be eradicated in the 1950s with a campaign against prostitution, has been booming again in China after the opening-door policy initiated in the early 1980s.[1] The burgeoning of the sex industry, along with a lack of self-protecting measures from HIV, poses a high risk of spreading HIV to the general population in China.[2–4] Although most notified HIV-positive cases in China are still among injecting drug users and former paid blood or plasma donors,[5] the rate of new infections among women is increasing; female sex workers (FSWs) are contributing to this increase.[6 7]

Knowing the size of the population of FSWs is important in effectively planning, managing and evaluating HIV/AIDS prevention and intervention programmes.[8] It is also essential in estimating the number of people living with HIV/AIDS.[9] However, most current HIV surveillance efforts among FSWs in China have focused on prevalence and risk behaviour. Little attention has been paid to the size of this population.[10]

Given the fact that commercial sex is illegal in China and sex workers usually work in various entertainment establishments with legal working licences,[3 11] it is difficult to develop standardised methods to estimate the size of this population.[8] Capture–recapture (CRC) methods perhaps are most widely used for population size estimation. However, the assumptions deemed highly desirable (two closed and independent sources of information, homogeneous in each source, which can be matched individually between them[12–16]) limit its application in estimating the HIV/AIDS population size. Reluctance to self-report risk behaviour in a household setting leads another popular estimation method—the household survey—to tend seriously to underestimate.[9] The census method (counting individual sex workers at their workplaces) is not suitable for hidden populations and large geographical areas, because it is almost impossible to get the large number of staff necessary to complete the count in a short time period.[8]

Unlike CRC methods, with the multiplier methods used in this study, it is not necessary to match individuals. The key issue in using this method is to find two sources of information that overlap in a certain way.[8] HIV/AIDS behavioural surveillance among high-risk populations, which usually include FSWs and attendees of sexually transmitted disease (STD) clinics, has been widely established in China. This provided a good opportunity for such estimation. Thus, we used a multiplier method to estimate the size of FSW populations by establishing an association between two high-risk populations—FSWs and attendees of STD clinics—on the basis of the behavioural surveillance approach.

METHODS AND STUDY DESIGN
Principle of the multiplier method

The basic principle of this method is that the number of people belonging to the population being estimated who appear at selected institutions or services during a certain time period is equal to the total size of the estimated population multiplied by the proportion of the population who attended the selected institutions or services during the same time period.[8 10] Thus, to estimate the population of the target group, an association was established between the populations of FSWs and STD attendees by combining the answers to several key questions on current behavioural surveillance questionnaires. The size of the FSW population was derived by the formula $N = m \times p1/p2$, where N is the size of the FSW population being estimated, m is the number of female STD attendees in selected STD clinics in a given time period, p1 is the proportion of FSWs among female STD attendees in selected STD clinics and p2 is the proportion of the FSW population who reported having attended the selected STD clinics during the same period.[8]

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Abbreviations: BSS, behavioural and social science; CRC, capture–recapture; FSW, female sex worker; STD, sexually transmitted disease

Table 1 Selected characteristics of female attendees of sexually transmitted disease clinics in two cities

Characteristic	Guiyang (n = 102)	Xingyi (n = 92)	p Value*
Mean (SD) age (years)	25 (7)	26 (8)	0.196
Marital status, n (%)			
Single	49 (48)	37 (40.2)	
Married	33 (32.3)	40 (43.5)	
De facto	16 (15.7)	12 (13)	
Divorced	4 (3.9)	3 (3.6)	0.446
Education, n (%)			
Primary school or unfinished	12 (11.8)	15 (16.5)	
Middle school	37 (36.3)	56 (61.5)	
High school	35 (34.3)	18 (19.8)	
University or higher	18 (17.7)	2 (2)	0
Current STDs, n (%)	78 (77.2)	87 (94.6)	0.001
Casual sex in the previous 3 months, n (%)†	54 (53.5)	45 (49.5)	0.578
Commercial sex in the previous 3 months, n (%)†	44 (43.1)	45 (48.9)	0.296

STD, sexually transmitted disease.
* χ^2 and Wilcoxon rank sum statistics were conducted.
†Excluding missing values.

Study sites and data collection

One big and one small city were chosen as the study regions: Guiyang, the capital of Guizhou Province, southwest China, with an urban population of 1.32 million, and Xingyi, a small city in the same province with an urban population of 0.18 million.

Data collection followed the protocol of HIV/AIDS behavioural surveillance among high-risk populations.[17] In Xingyi, all 16 registered clinics that provide STD services were included in this study. In Guiyang, two criteria were considered during the selection process: selected clinics should be located in different parts of the city and the average number of female clients should not be too small. According to advice from the local Department of Health, we classified all the 72 registered medical institutions with STD services into three categories: STD departments in public hospitals (n = 8), STD departments in private hospitals (n = 47) and private clinics (n = 17). A quarter of these clinics were then selected from each subgroup to provide the Guiyang sample. Female STD attendees admitted to the selected clinics (except for those who came for sex counselling or were <14 years old) were interviewed by their doctor after informed consent had been obtained. Those who had exchanged sex for money in the past 3 months were defined as sex workers. The number of female STD attendees (m) during 3 or 6 months (3 months in Xingyi, but 6 months in Guiyang, given its relatively large FSW population, which were consistent with the time periods used in the surveys among FSWs when they were asked whether they attended the selected clinics) was determined according to the medical records of the clinics.

A two-stage cluster sampling design, based on a comprehensive list of entertainment establishments and their corresponding estimated number of sex workers, was used to conduct the surveys among FSWs in Xingyi and Guiyang. For street-based FSWs, estimated samples were taken according to the roughly estimated size of this group in the whole FSW population in each city. A list of the STD clinics that were selected for use in the survey of female STD attendees was highlighted on the FSW questionnaires by including the names and addresses of the clinics and the names of doctors. FSWs who agreed to participate were anonymously interviewed at their workplaces as to whether they had visited the selected clinics in the given time period as well as times and dates of their visits. For sex workers who visited the selected STD clinics several times during the study period, only the first visit was considered for calculating the proportion p2.

RESULTS

Female attendees of STD clinics

Over 3 weeks in November 2003, 194 female STD attendees were interviewed (92 in Xingyi and 102 in Guiyang; table 1). None of those approached refused to be interviewed. Most women were young, had less than a high school education and were diagnosed to have at least one type of STD. With regard to sexual behaviour, 53.5% of the women recruited in Guiyang had had casual sexual partners in the past 3 months and 49.5% in Xingyi; 43.1% had had commercial sex in the past 3 months in Guiyang, which was similar to the 48.9% in Xingyi.

Characteristics of FSWs

During December 2003, 629 individual FSWs were interviewed in the two cities (322 in Xingyi and 307 in Guiyang). Table 2 indicates that most of them were young, single and had a lower educational level (65.5% in Guiyang and 83.9% in Xingyi never went to high school, p = 0). Regarding STD history, 28% of FSWs in Guiyang had seen a doctor because of symptoms of STD in the previous 3 months, which was similar to the proportion in Xingyi (25.7%, p = 0.518). In Guiyang, 4.2% (95% CI 2.3% to 7.1%) had attended the selected STD clinics in the past 3 months, and the proportion was 16.2% (95% CI 12.2% to 20.8%) in Xingyi.

Size of the FSW population

The sizes of the FSW populations in two cities were then calculated (table 3). In Guiyang, a total of 1703 female attendees had visited the selected STD clinics in the previous 6 months and 43.1% of them were sex workers. According to the survey among FSWs, 4.2% of them had sought a medical consultation in the selected clinics over 6 months. Hence, the size of the FSW population in the urban area of Guiyang would be 17 500 (1703×43.1%/4.2%), with a 95% CI of 10 300 to 31 900 (rounded to the nearest 100), which accounted for about 3.4% of the urban adult female population. Similarly, there were 2500 (rounded to the nearest 100) FSWs in the urban area of Xingyi, with a 95% CI of 2000 to 3400 (rounded to the nearest 100), which was about 3.6% of its urban adult female population.

DISCUSSION

Although the multiplier method has been used to estimate the size of other at-risk populations such as men who have sex with men and injecting drug users,[10 18] this is the first time it has been applied to estimate an FSW population, using existing data from behavioural surveillance groups—STD attendees and FSWs. The result suggests that combining this method with the HIV/AIDS behavioural surveillance to produce population size estimations is feasible and cost effective.

Compared with CRC, population surveys and census methods,[8] the multiplier method used in this study has its advantages. Firstly, just by incorporating several relevant questions into the routine behavioural and social science (BSS) questionnaires, the necessary parameters for the estimation can be simply obtained. No sophisticated mathematical or statistical skills are needed and there is no requirement to match individuals between two sources, which

Table 2 Selected characteristics of female sex workers in the two study cities

	Guiyang, (n = 307)	Xingyi, (n = 322)	p Value[†]
Mean (SD) age (years)	24 (6)	22 (4)	0.001
Marital status, n (%)			
Single	226 (73.6)	211 (65.6)	
Married	41 (13.4)	51 (15.8)	
Divorced	29 (9.5)	31 (9.6)	
De facto	11 (3.5)	29 (9)	0.024
Educational level, n (%)			
Primary school or unfinished	70 (22.8)	60 (19.4)	
Middle school	131 (42.7)	198 (64.1)	
High school	100 (32.6)	49 (15.9)	
College and higher	6 (1.9)	2 (0.6)	0
Mean (SD) length of career as sex worker (months)	14.5 (14)	18.5 (19.6)	0.005
Mean (SD) length of career as sex worker in the study city (months)	11.8 (11.3)	12.3 (13.4)	0.645
Attendance at STD clinics[*], n (%)	86 (28)	81 (25.7)	0.518
Attendance at the selected STD clinics[*], n (%)	13 (4.2)	47 (16.2)	–

STD, sexually transmitted disease.
[*]STD history covered the past 3 months in Xingyi and the past 6 months in Guiyang.
[†]χ^2 and Wilcoxon rank sum statistics were performed.

is required by the CRC method. Therefore, it is straightforward and cost effective. Secondly, combining this method with the BSS, estimates can be obtained annually and trends in the size of FSW populations with time can be observed. Furthermore, this method can be generalised to the whole BSS, and thus estimates can be obtained for broader geographical areas.

Several key issues must be kept in mind in using multiplier methods successfully for FSW population size estimation. Firstly, a clear and consistent definition of FSWs in different surveys should be used. In this study, if a female STD attendee had exchanged sex for money in the past 3 months, then she was defined as a commercial sex worker. This definition might not be consistent with the one used in surveys of FSWs, where only those females who were currently working as sex workers were interviewed. If the proportions of FSWs who have just quit a sex career and those who are new to the business in the previous 3 months are low, this issue might have little effect on the estimation.

Secondly, the proportion of female STD attendees who are sex workers is a critical parameter to estimate the population size. Only about 200 female STD attendees were interviewed in this study. It is difficult to speculate on the selection bias caused by this low number. In addition, the underreporting of commercial sex behaviours caused by female STD attendees intentionally concealing their involvement in illegal sex in China could lead to an underestimation. However, in this study,

doctors were specially trained to elicit true information from patients. Moreover, in China patients are usually very trusting of doctors and are willing to tell them the truth to help cure diseases.

Thirdly, this study was based on the assumptions that p1 and p2 were stable over a certain time period. This provided a practical advantage that those FSWs who were identified in the selected STD clinics were not necessarily those who reported having attended selected STD clinics. However, it is difficult for us to absolutely validate any of these assumptions.

Finally, the catchment area for the selected STD clinics should be ideally the same as that covered in the FSW survey from which multipliers are derived. In other words, when investigating FSWs to obtain p2, the sample of FSWs should be representative of the FSW population working in the catchment areas of the selected STD clinics. This is important because the health-seeking behaviours are reportedly different for different levels of sex workers. However, it is difficult to draw a randomised sample on a probability basis. In this study, although we used a two-stage sampling design based on a comprehensive mapping process of different types of entertainment establishments and their estimated number of sex workers, these estimates are probably still rough; therefore, it is difficult to estimate selection bias.

This study also found shocking numbers of FSWs in the two southwest cities of China: 3.4–3.6% of the urban adult female populations. The prevalence of FSWs is considerably higher

Table 3 Estimations of the number of female sex workers in two cities

City	Female STD attendees in selected clinics within 3 or 6 months (n)[*] m	FSWs among female STD attendees (%) p1	FSWs who attended selected STD clinics in the past 3 or 6 months (%)[†] p2	Estimated number of FSWs N = m × p1/p2
Xingyi	842	48.9	16.2 (12.2 to 20.8)	2500 (2000 to 3400)
Guiyang	1703	43.1	4.2 (2.3 to 7.1)	17500 (10300 to 31900)

FSW, female sex worker; STD, sexually transmitted disease.
Values in parentheses are 95% CI.
[*]Xingyi survey duration, 3 months; Guiyang, 6 months.
[†]Rounded to the nearest 100.

Key messages

- Multiplier methods were used to estimate the size of female sex worker (FSW) populations on the basis of the behavioural surveillance approach among FSWs and sexually transmitted disease (STD) attendees.

- It was estimated that the population of FSWs in Guiyang and Xingyi was approximately 17 500 and 2500, respectively, accounting for 3.4% and 3.6% of urban adult women in each city.

- The combination of multiplier methods with the behavioural surveillance to estimate the size of the FSW population is straightforward, cost effective and feasible.

than in some other Asian countries. The increasing income disparities between rural and urban areas, poverty among women, and labour mobility have made numerous women migrate from country to metropolitan regions to seek better lives. Facing a competitive job market with lack of education and skills, selling sex becomes a feasible and more lucrative way surviving for many of them.[20][21] The sex trade is becoming a huge challenge to HIV/AIDS control and prevention in China.

Limitations of this study should be acknowledged. Firstly, the size estimation in Guiyang has a large CI, which makes the estimation less useful for HIV/AIDS programme planning and management. Therefore, a relatively large sample size of FSWs in the community survey should be taken and more STD clinics should be selected in future studies. Secondly, some non-qualified and non-registered clinics may also provide STD services (eg, backyard service), but the FSW cannot tell which clinics are registered and allowed to provide STD services and which are not. Therefore, the proportion who self-reported visiting STD clinics is higher than the proportion of those actually visiting selected clinics, and this might have had an effect on the result.

In conclusion, despite the limitations of the multiplier method, its simplicity makes it more reliable and suitable for use in countries where HIV/AIDS behavioural surveillance has been established in high-risk populations and where existing data sources that can be used for population size estimations are few and less accurate.

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